

TIH:

Sinewave Oscillators

Unclassified

4 Hour Conference, W/ 6Hr PE1

**Safety & Environmental Impact is
“LOW”**

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Terminal Learning Objective

ACTION:

Given Schematic diagrams & Ckt Operational concepts of the Hartley, Colpitts, RC Phase Shift & Crystal Oscillators answer all Questions

CONDITION: W/O Reference.

STANDARD: A minimum accuracy of 70%.

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Introduction

The basic signal generating source for electronics Ckts is the Oscillator.

It is used extensively in defense & in the private sector for timing & carrier wave transmission.

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Lesson Terms;

Oscillator [Osc]; The basic signal generating source for electronics Ckts.

1. Converts DC to AC.

2. Operates in the Audio & Radio Range, AF & RF.

3. 4 Requirements of an Osc { Free running or No external AC source }

a. DC Voltage.

b. Regenerative Feedback, [Sustains the Oscillations].

c. An Amplifier.

d. Frequency Determining Device, [FDD].

Dampening; Diminishing signal strength due to Ckt loss in Osc.

The Ckts ability to maintain a constant signal amplitude & frequency

Types; 1. Tank Ckt.

2. RC Phase shift.

Stability

Feedback

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Regenerative Feedback; Sustains the Oscillations.



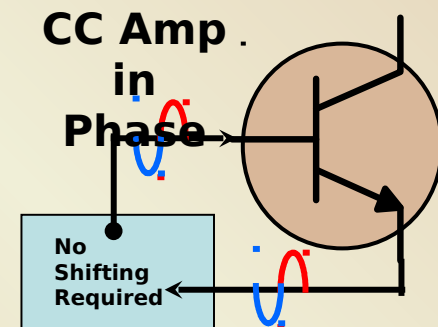
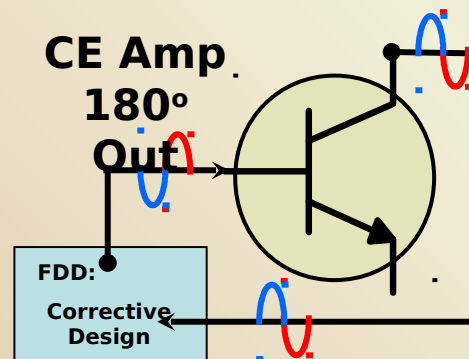
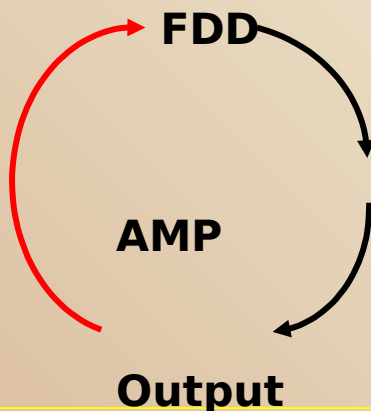
Regenerative Feedback;

1. When the part of energy in the Ckt is used to sustain or maintain the Oscillations in the FDD & prevents Damping.

2. Feedback must be in Phase from the output to the input.

3. A 180° Phase shift will cancel out the Osc.

{Corrective design will overcome the 180° phase shift}.

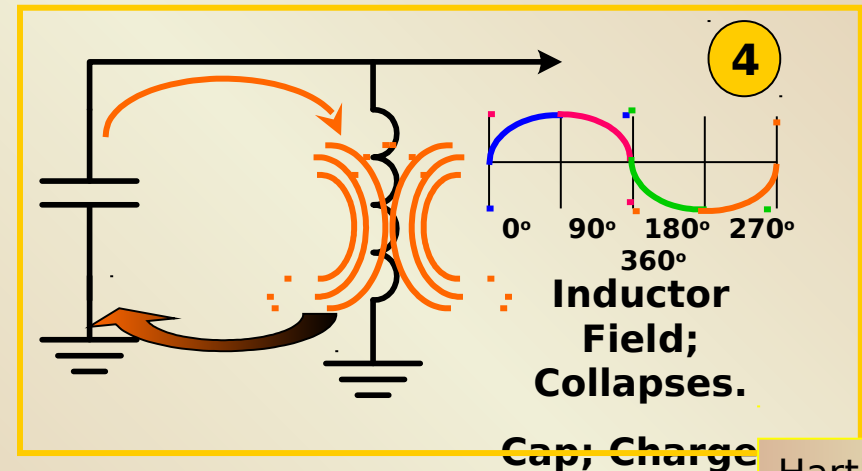
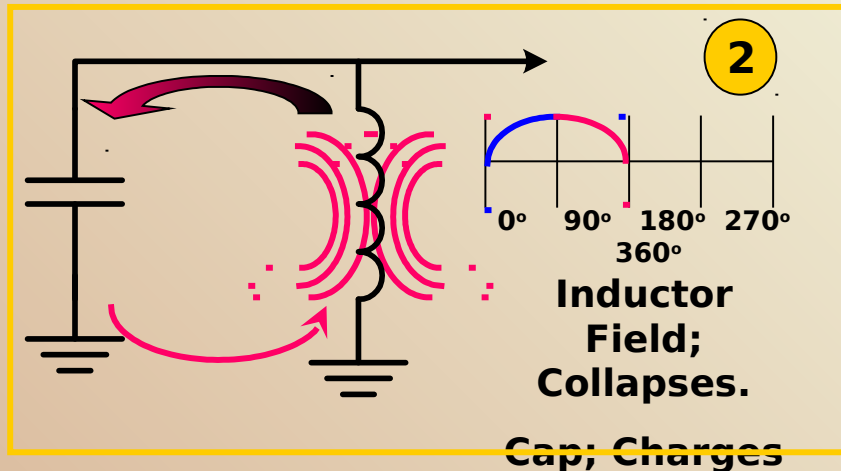
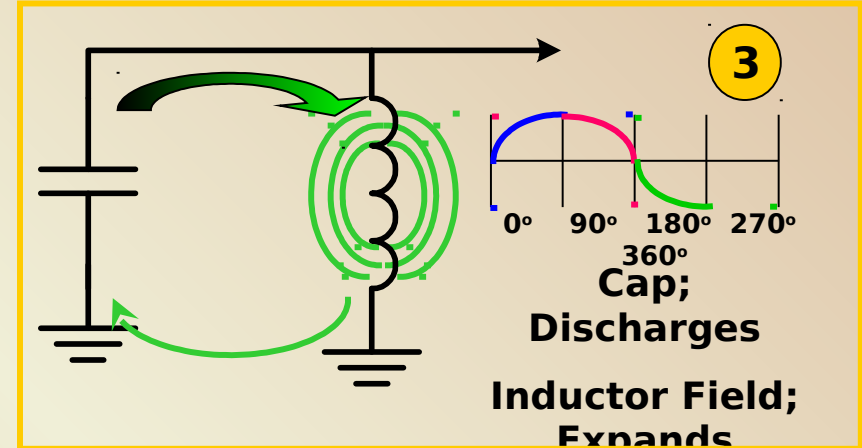
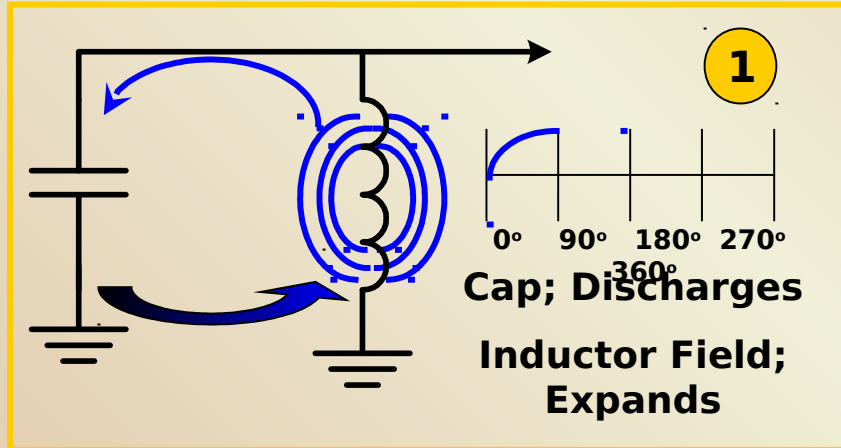


Tank Ops

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Tank Ckt Ops; Parallel Resonate Ckt.



Hartley

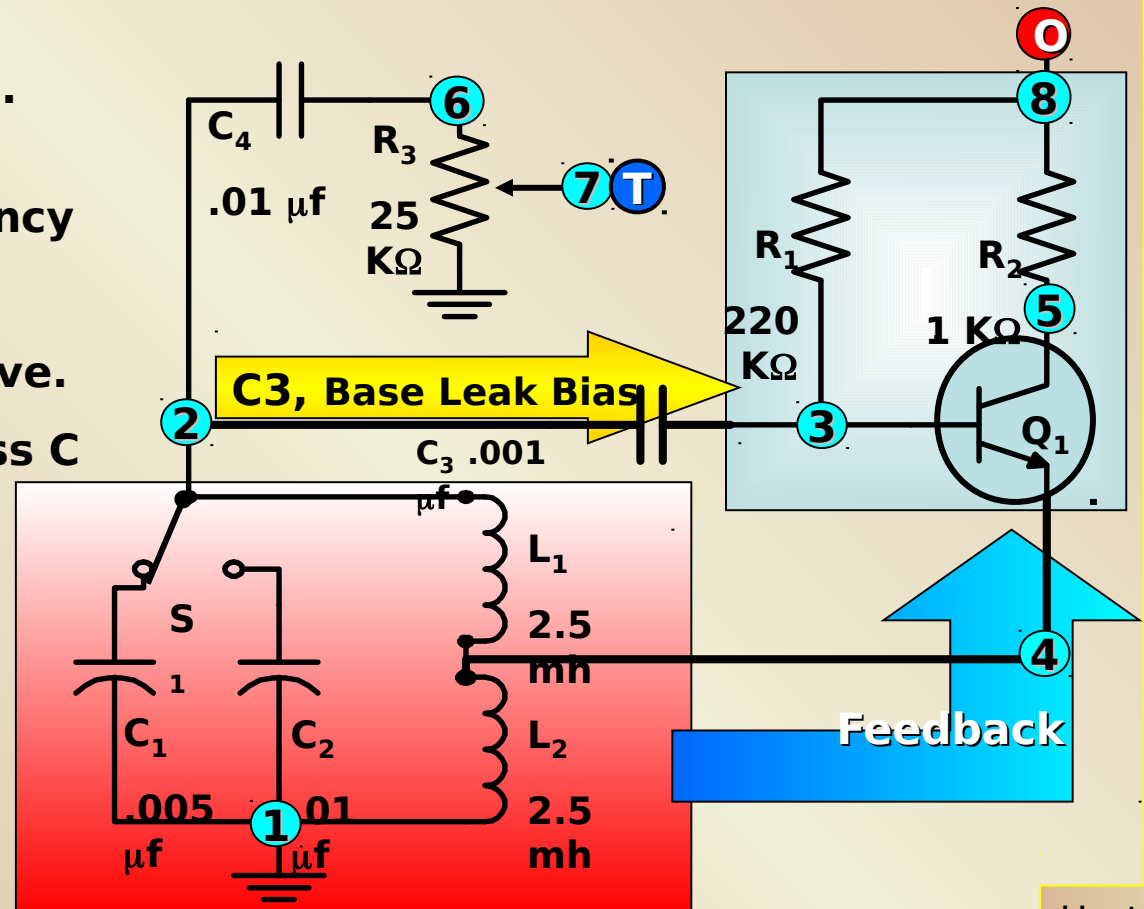
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Hartley Oscillator PC 35; Block Diagram.

Creature Features;

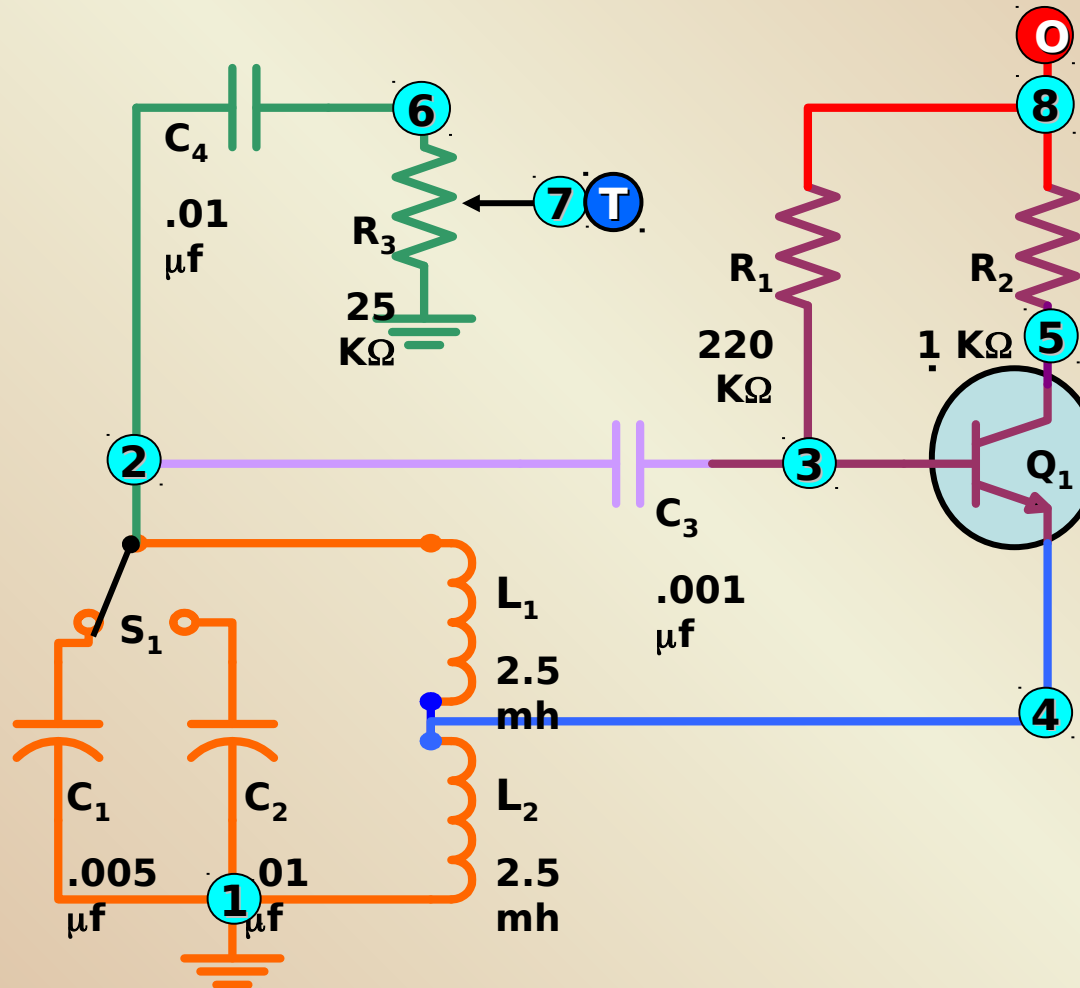
1. ID by Split Inductors.
2. Ops @ Audio Frequency
[AF] 20HZ-20Khz.
3. Output, is a Sign wave.
4. Most efficient @ Class C
Ops.
5. Not very stable.



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Hartley Oscillator PC 35; Component & Ckt ID.

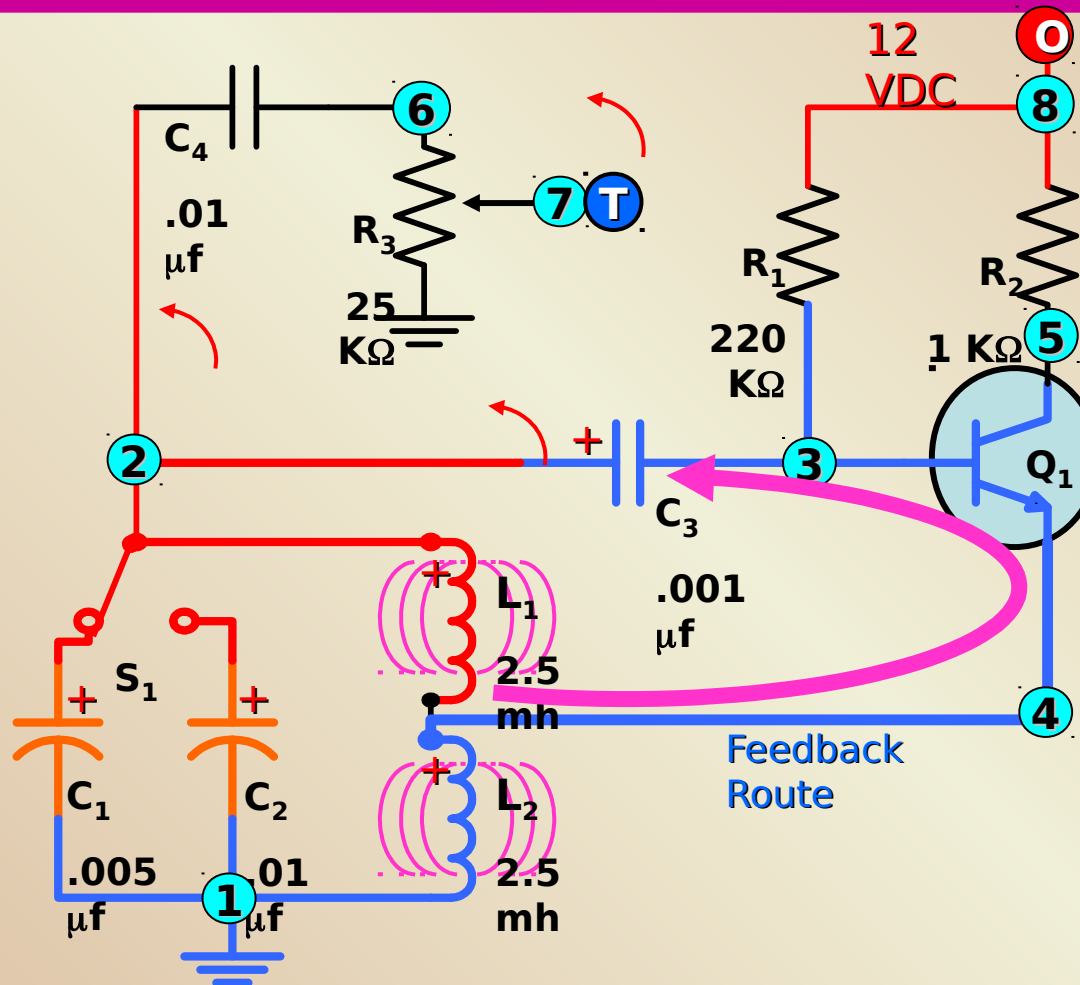


Ops

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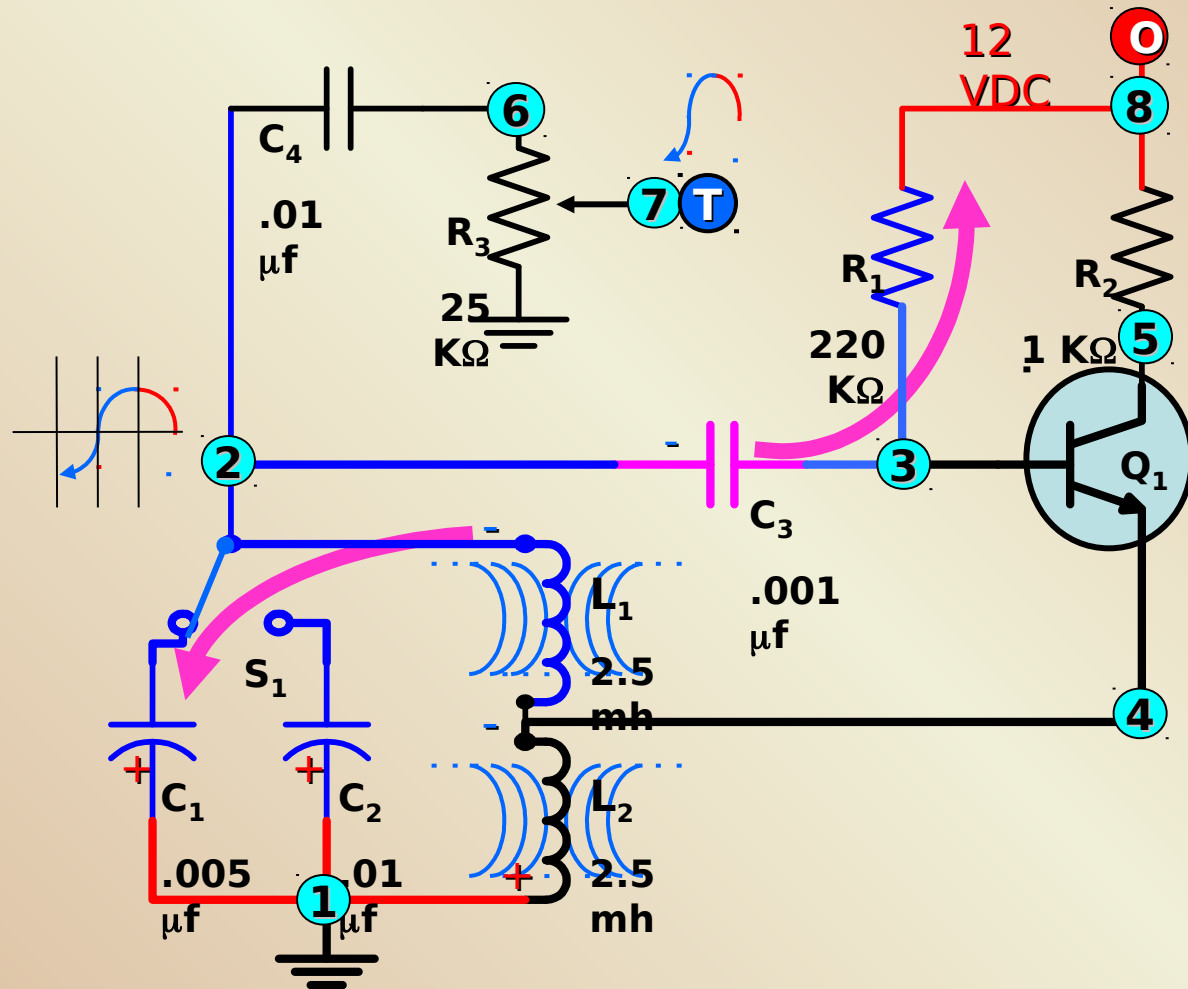
**Hartley Oscillator PC 35; 12 VDC applied, Tank Energized,
 Q_1 On.**



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Hartley Oscillator PC 35; Q_1 Cuts Off.

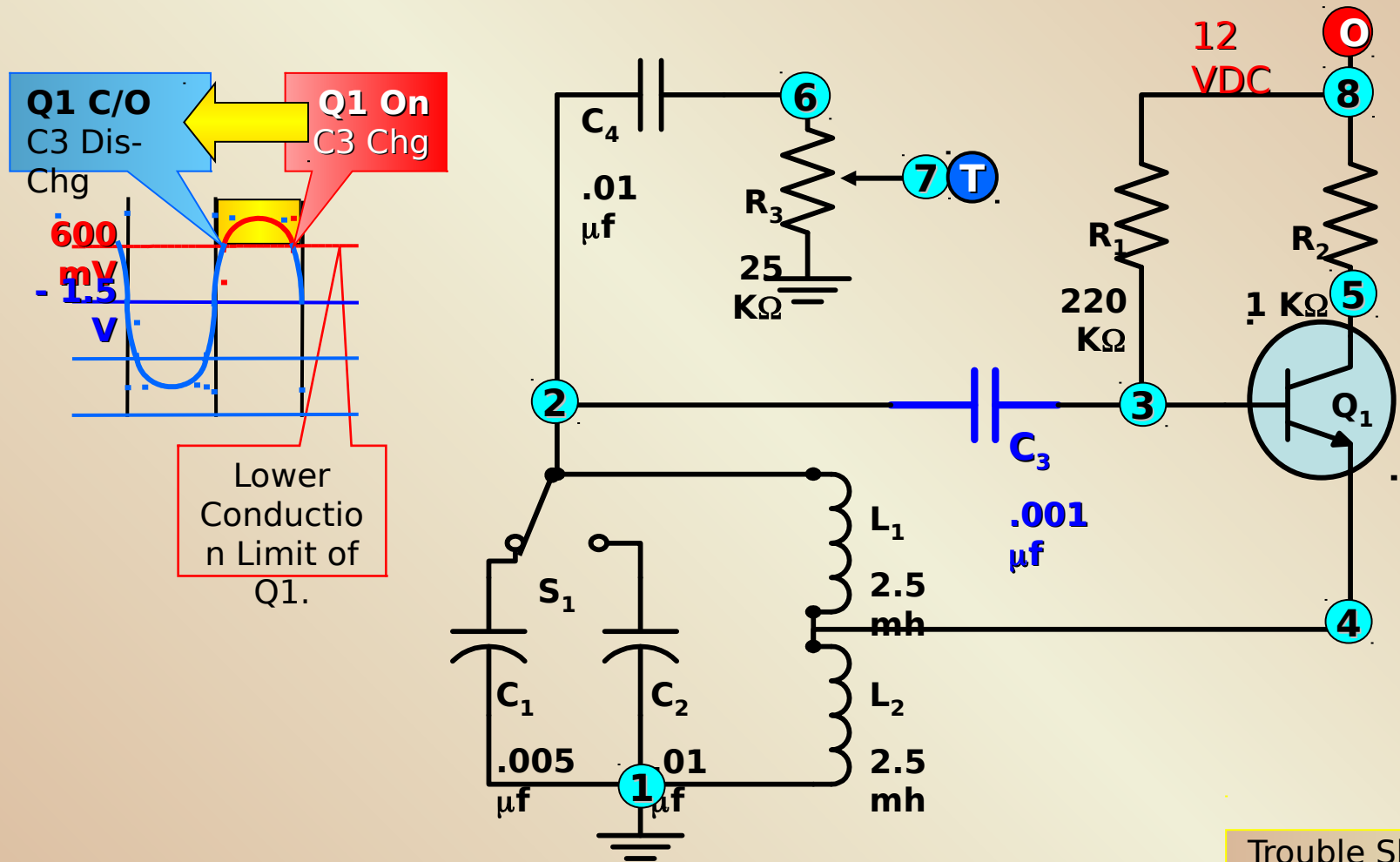


C3 Base Leak Bias

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Hartley Oscillator PC 35; C_3 Base Leak Bias.



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Hartley Oscillator PC 35; Troubleshooting Procedure.

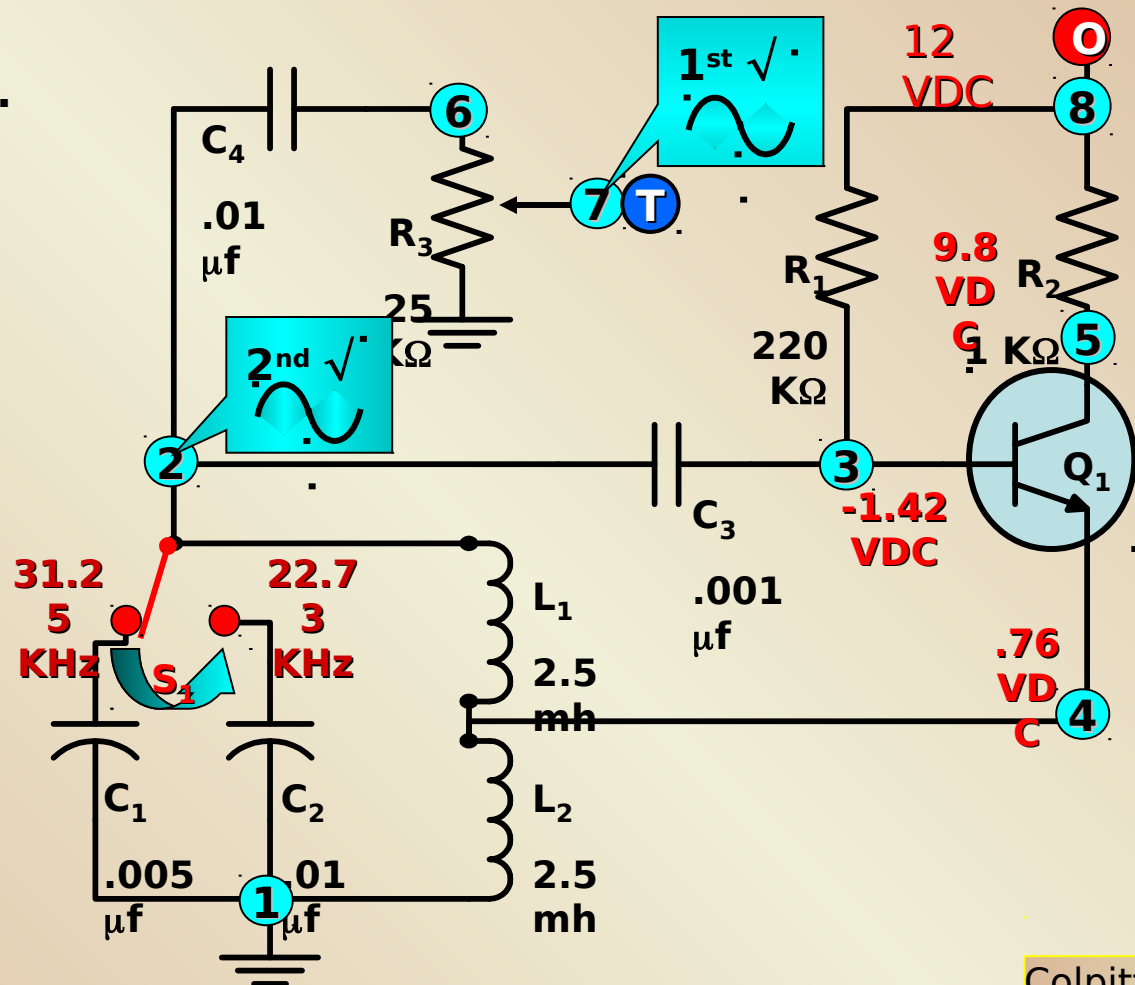
1. TP7, Output, R3
Adjust Amplitude.

2. TP2, No Signal
Change position
S1.

If Signal returns
problem is in C1.

TP2, Signal in
Both positions of
S1.

3. DC Checks on Q1
TP **5**, **3**, **4**.

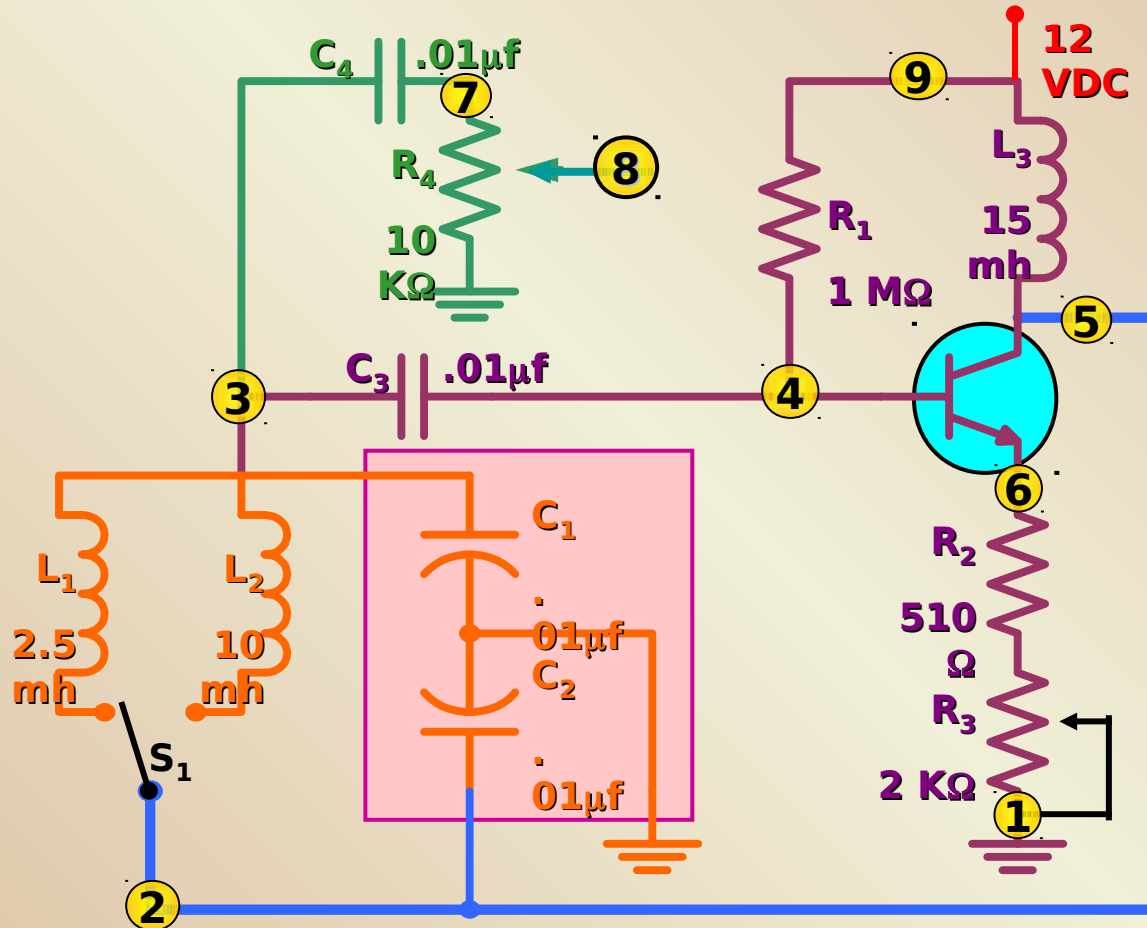


Colpitts Osc

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Colpitts Oscillator, PC 36; Component & Ckt ID.

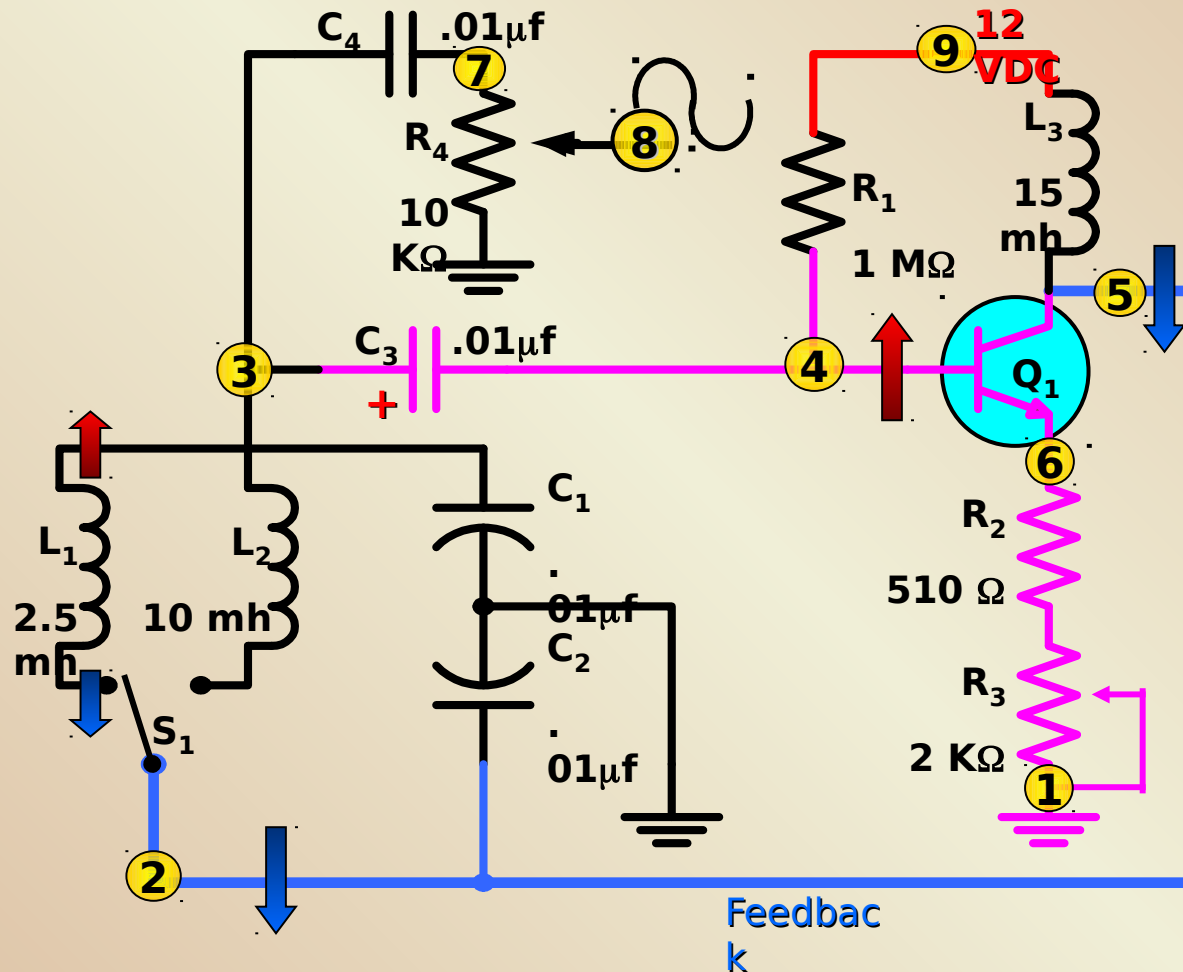


Ops; Q1 On

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Colpitts Oscillator, PC 36; Q1 Conducts.

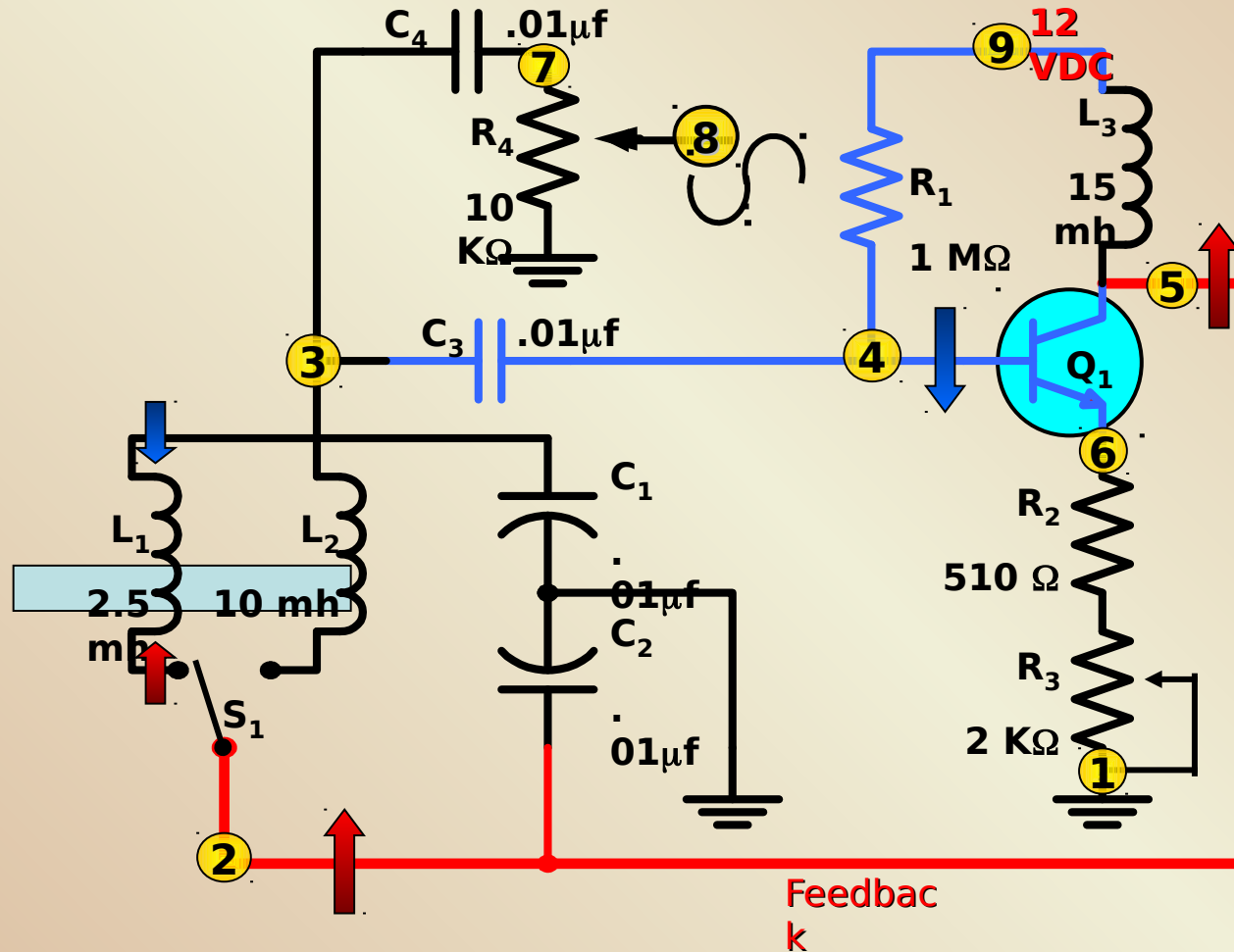


Cutoff

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Colpitts Oscillator, PC 36; Q1 Cutoff.

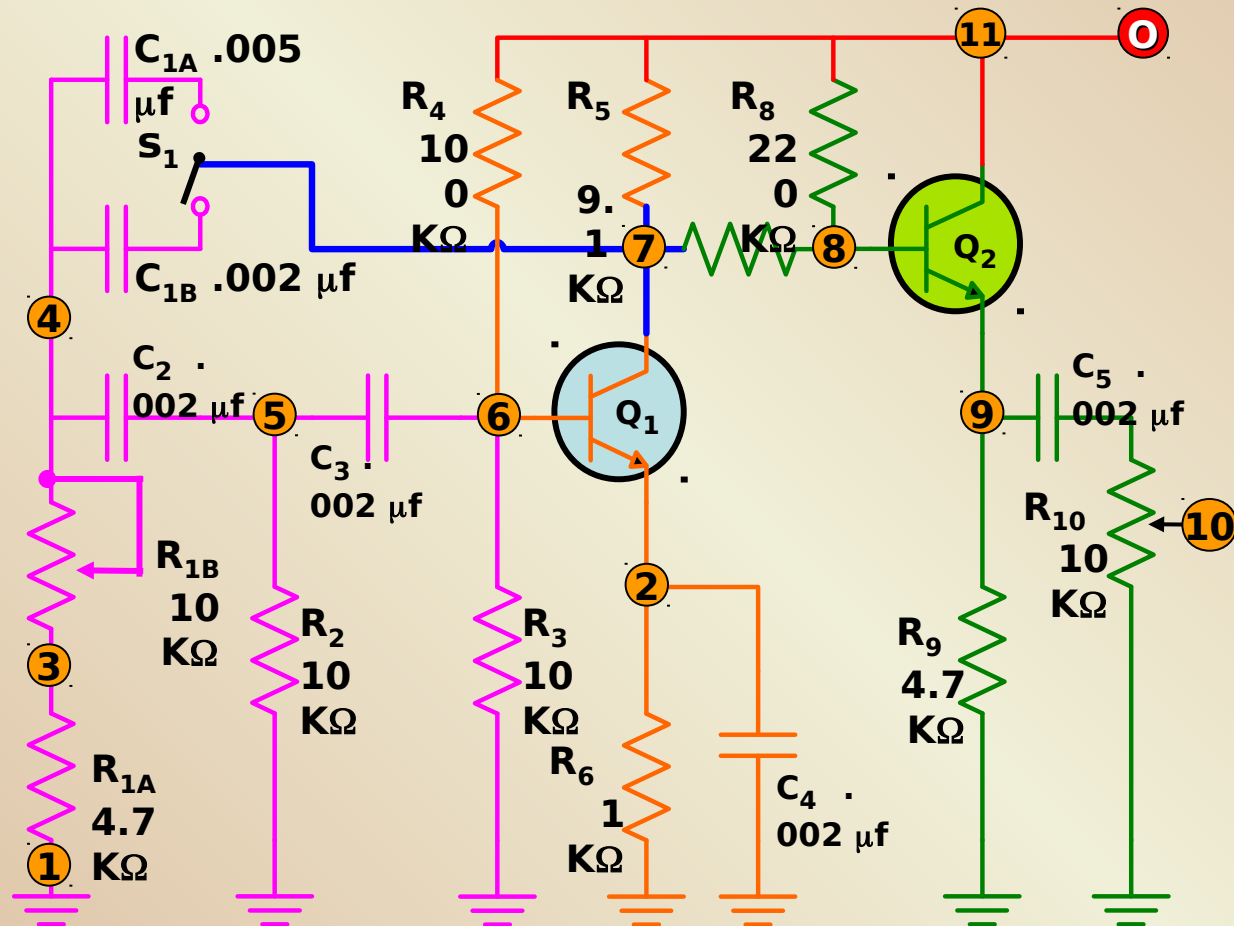


RC P. S.

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RC Phase Shift Oscillator, PC 37; Component & Ckt ID.

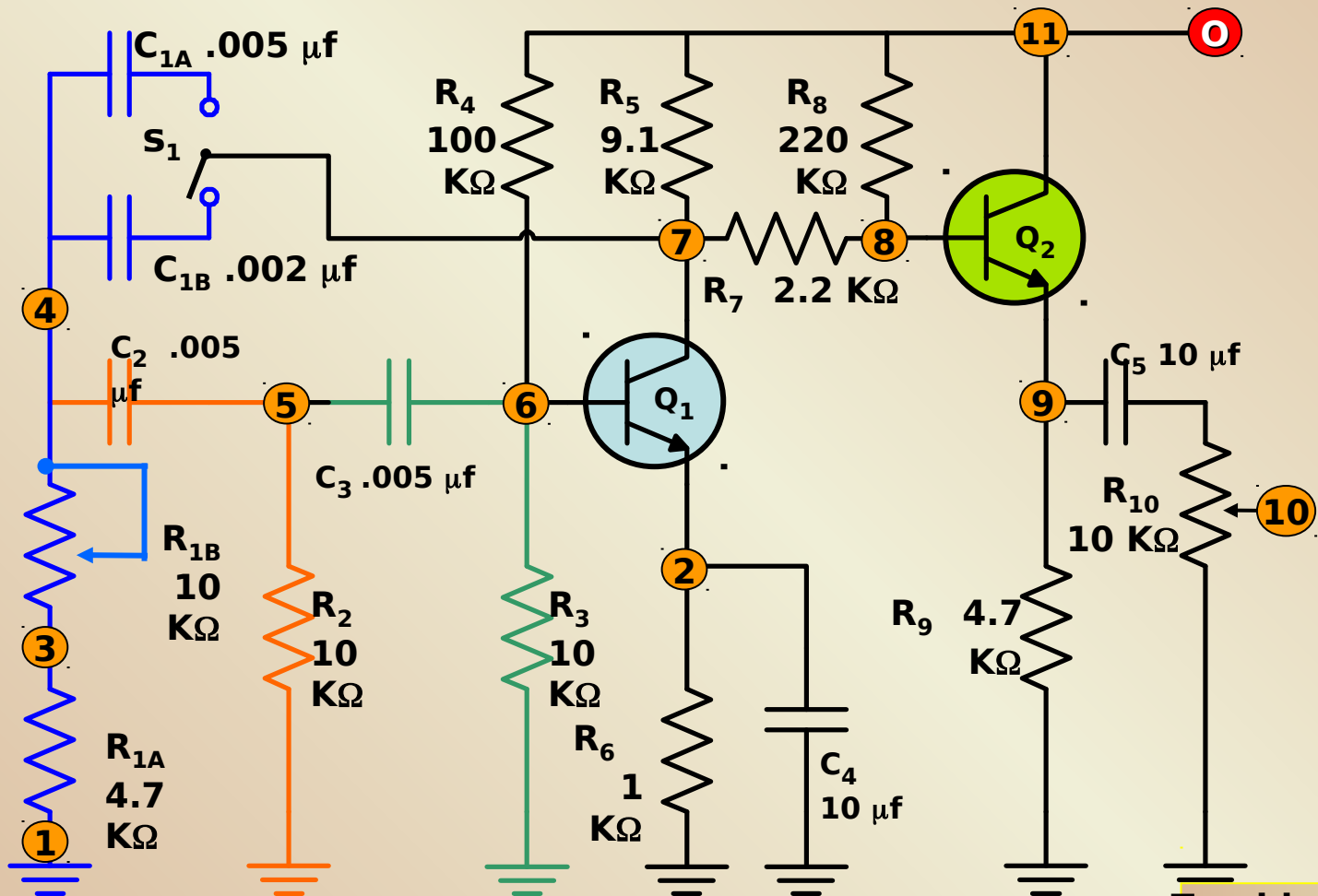


FDD

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RC Phase Shift Oscillator, PC 37; FDD.

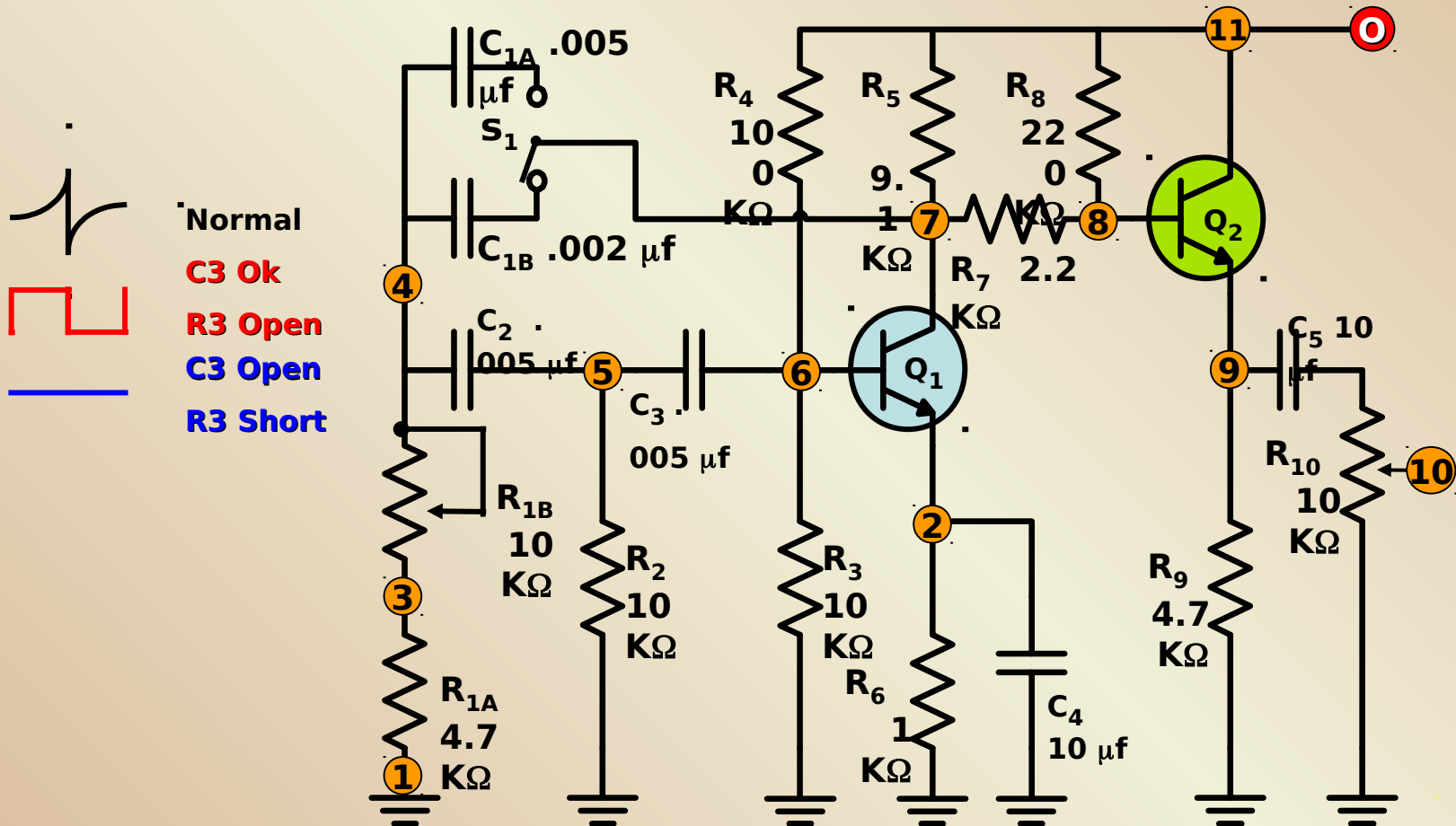


Troubleshooting

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RC Phase Shift Oscillator, PC 37; Signal Injection.

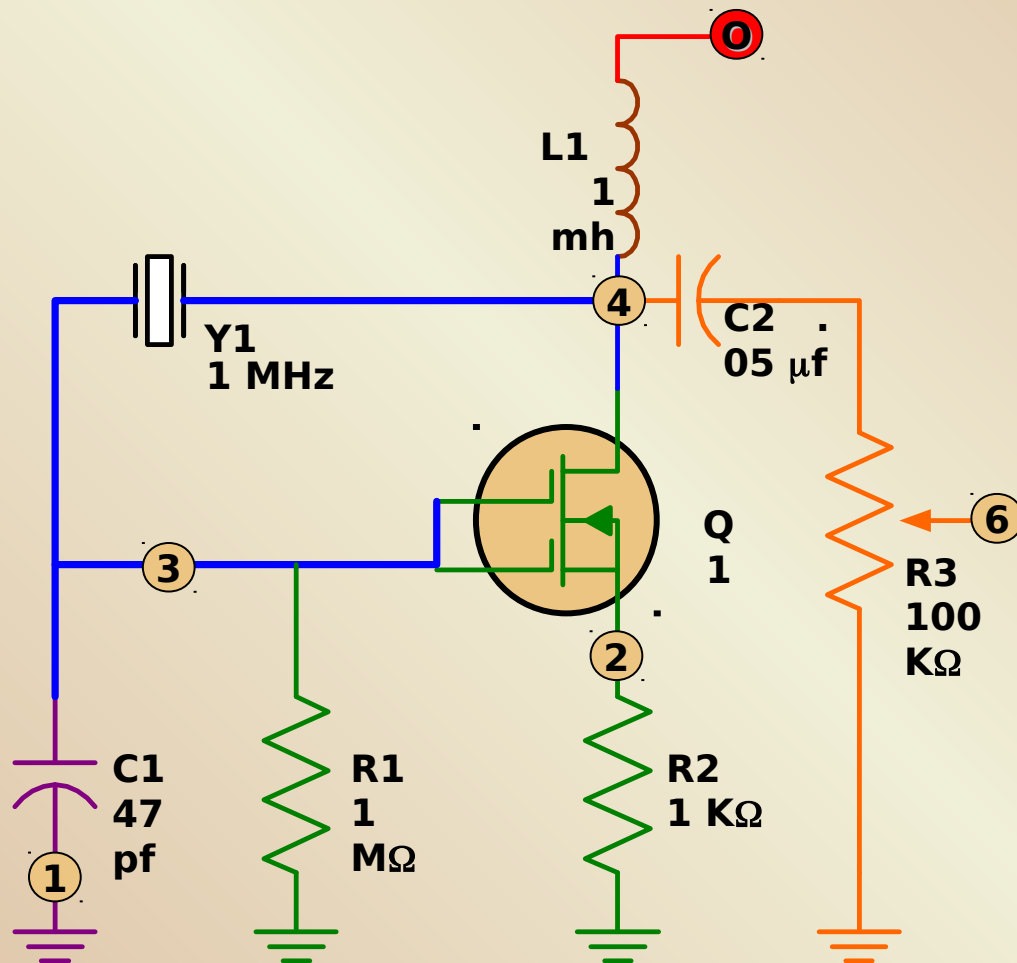


Crystal

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Crystal Oscillator, PC 50; Component & Ckt ID.



Piezo Electronics

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Piezo Electric, Crystals.

1. **Crystals, Stability is the best, used to generate carrier wave transmission, Microphones & Speakers.**
2. **Piezo Electricity, [Piezo electric effect]; The process of converting Mechanical stress to Electrical, or vise versa.**
3. **Crystal Benefits; Cheap, Plentiful {Quartz}, Strong, can be cut & sliced to operate W/in specific ranges, Maintains its stability.**
4. **High Current will burn a crystal.**
5. **Operational/ Physical Characteristics;**

**Crystal slab thickness determines the resonance frequency.
There can be more than one.**

Lowest; called the Fundamental Frequency.

**Higher; called the Overtones. Usually a multiple of the
fundamental frequency.**

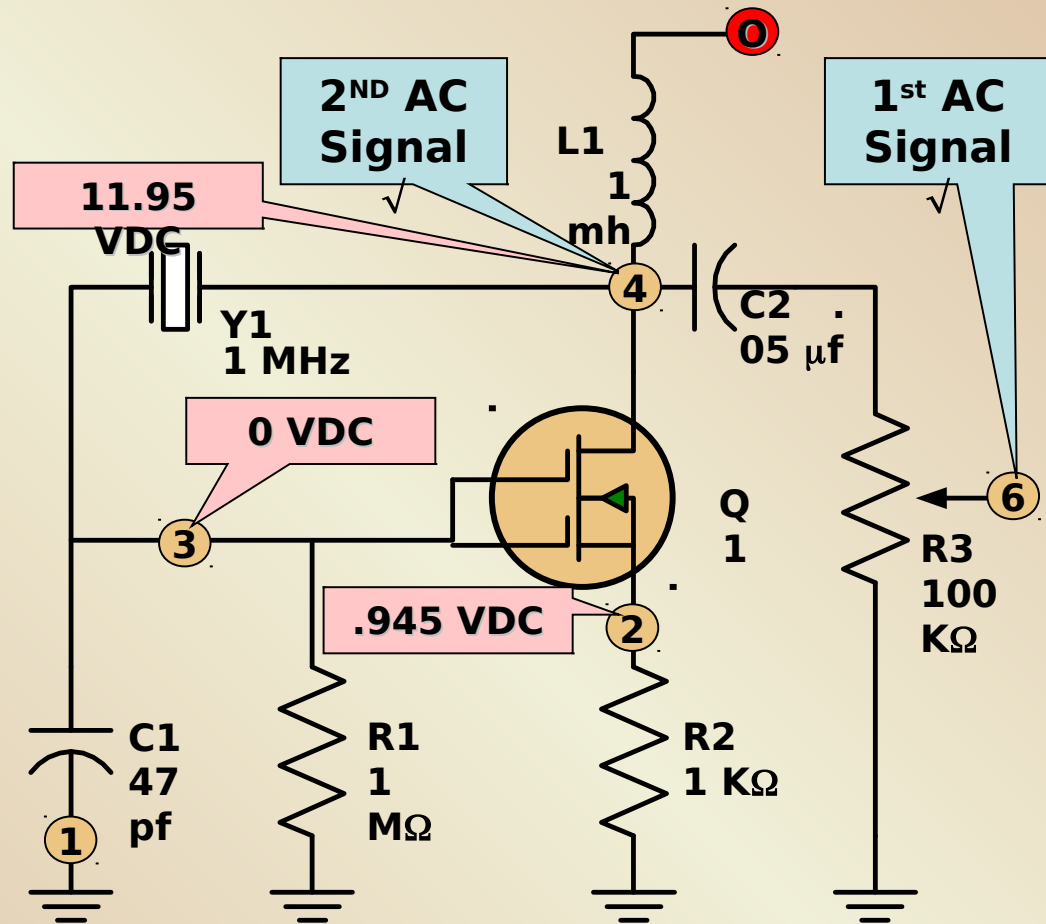
Thinner the slice the higher the frequency

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PC 50, Troubleshooting Sequence.

TP2 = 11.64 VDC

Trouble shooting is accomplished just like any other transistorized Ckt.



Review Lessons

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Review Questions:

1. What are the four requirements for a circuit to function as an oscillator? a. _____ b. _____ c. _____ d. _____
2. Name the four oscillators discussed in this lesson. a. _____
b. _____ c. _____ d. _____
3. Why is regenerative feedback required in oscillators? _____
4. Name some examples of frequency determining devices studied in this lesson. _____
5. What type of characteristic is displayed in quartz crystals.

6. What is the identifying feature of a Hartley Oscillator? _____
7. What is the identifying feature of a Colpitts Oscillator? _____
8. What component [s] determine [s] the output frequency of the series fed Hartley Oscillator? _____
9. What class of operation is most efficient for a Colpitts or Hartley Oscillator. _____

Answers 1-9

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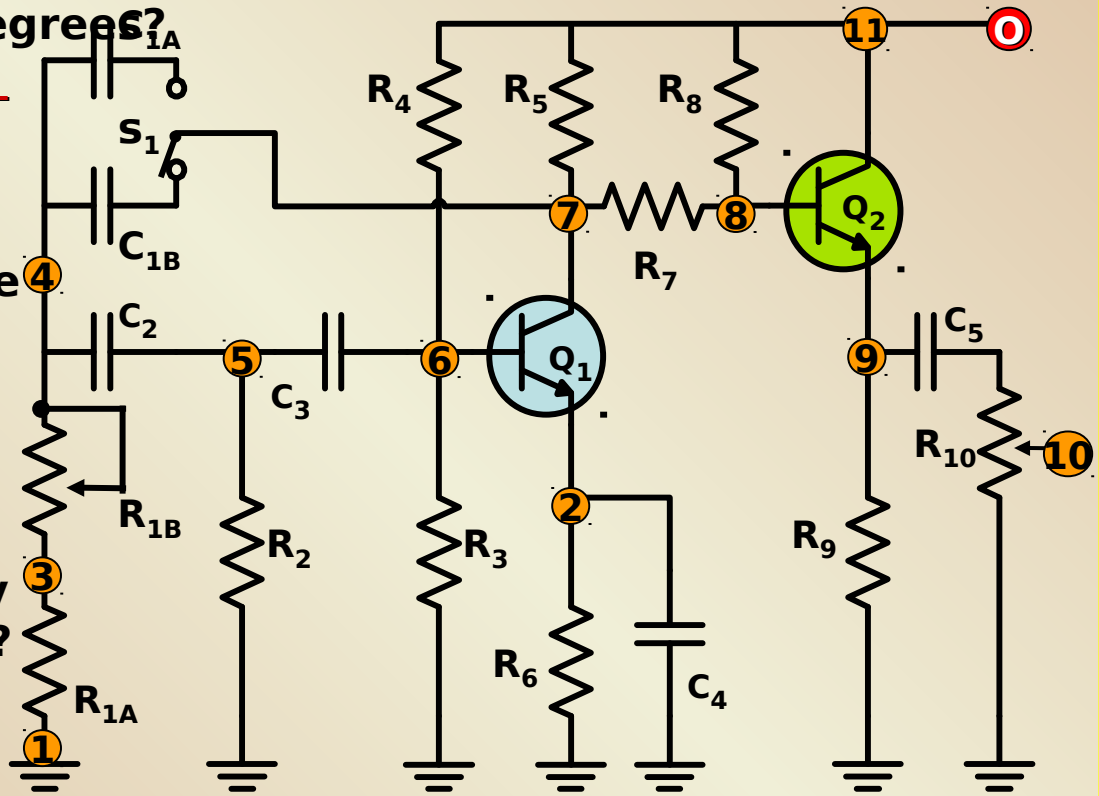
Review Questions:

10. Refer to PC 37. The component combination C3 R3 will shift or delay the signal by how many degrees?

11. Refer to PC 37. How much phase shift is provided by the entire phase shift network?

12. What is the purpose of Q2 ?

13. How is the frequency of PC 37 established ?
{Principle of Operation }



Answers 10-13

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Review Questions:

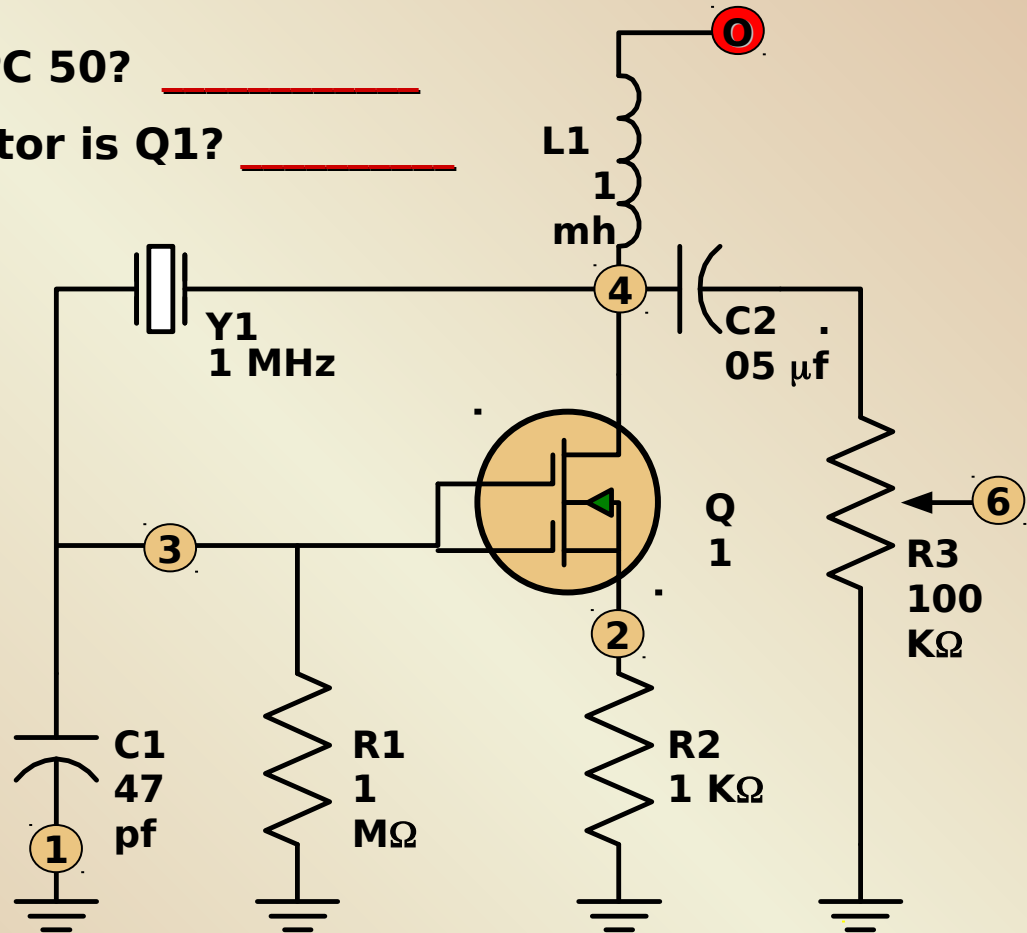
14. What is the FDD in PC 50? _____

15. What kind of transistor is Q1? _____

16. Why are Crystals especially useful in radio communications equipment?

17. What is the most commonly used material to make an oscillator crystal?

18. What is meant by Resonant Frequency?



Answers 14-18

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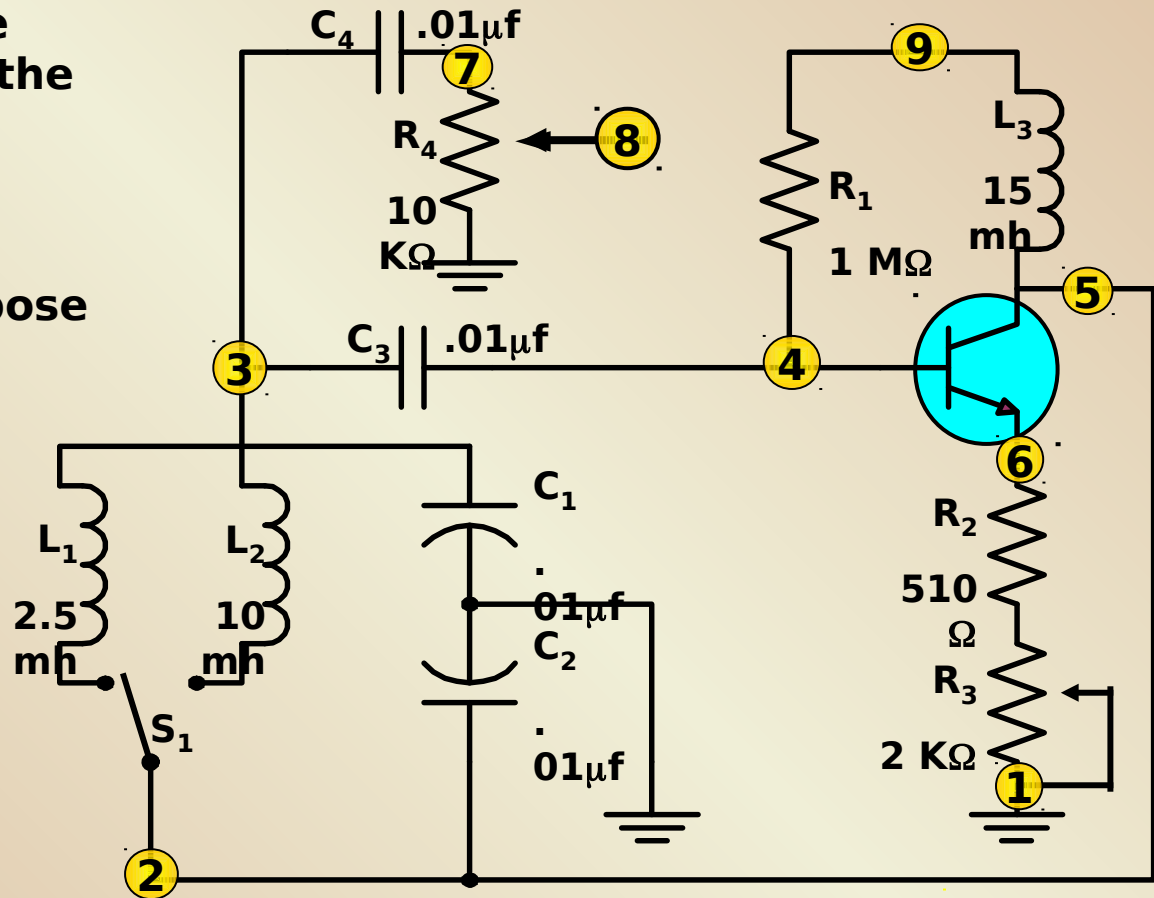
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Review Questions:

19. The thinner the Crystal _____ the its resonance frequency.

20. Refer to PC36.
What is the purpose of L3?

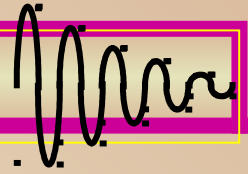
21. What is the usual output of the Hartley or Colpitts Oscillator?



Answers 19-21

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Lesson Test;

Lesson Test:

**Standard: 10 Questions W/in 20
Minutes. 70% Minimum
Accuracy. Reference: None.**